335

GENERAL INSTRUCTIONS

international light

MP MASTER
MA28471

GENERAL INSTRUCTIONS

IL335
EXPOSURE INTEGRATOR AND PHOTOMETER

INTERNATIONAL LIGHT, INC.
DEXTER INDUSTRIAL GREEN
NEWBURYPORT, MASSACHUSETTS
01950
(617) 465-5923

1.0 GENERAL INFORMATION

1.1 The IL335 exposure control can be utilized either as a sensitive UV-Visible photometer-radiometer or as an automatic integrating exposure control.

2.0 USE OF THE IL335 AS A PHOTOMETER-RADIOMETER

2.1 Six overlapping ranges of sensitivity are provided for a dynamic sensitivity range of 300:1. The most sensitive range is indicated by the .03 position and the least sensitive range is correspondingly indicated by the 10 position. These numbers on the input current selector switch indicate the full scale value on the panel meter. The panel meter has two scales (0 to 100 and 0 to 30). By selecting the proper sensitivity scale it is never necessary to make a reading in the lower 30% of the scale.

2.2 The panel meter reads out in microamperes of input current from the Photosensor. This microampere reading can be converted to units of irradiance or illuminance by means of a calibration factor. This conversion is explained in paragraphs 6.2 and 6.3 of this manual.

3.0 ZERO

3.1 There is a zero control knob located on the front panel. This control is provided to zero out the dark current of the photosensor.

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4.0 PT100 PHOTOSENSOR ASSEMBLY

4.1 The PT100 remote sensor assembly consists of a vacuum photodiode with an S-5 spectral response, photodiode housing, and a threaded optical input. The standard optical input has a quartz diffusion plate. The threads on the inside diameter of the optical input are designed to accept International Light Type WB Optical Glass Filters, NB Optical interference filters and ND Neutral density filters. Reticles, hoods and fiber optic adapters are also available.

4.2 The PT100 sensor assembly is equipped with a 9-Pin male connector which mates with the female connector on the front panel.

4.3 The PT100 sensor assembly can also be used with International Light model IL600 Research Photometer.

5.0 MEASUREMENT PROCEDURE

5.1 Sensor-Console Connection: Before connecting the sensor to the console, place the sensitivity selector switch in the OFF position. The sensor is equipped with a 9-Pin male connector. The pins are lettered to permit proper alignment with the female connector on the control panel.

5.2 Before measuring the irradiance of a source, make sure that the input current selector switch is on the least sensitive range. Switch toward the more sensitive

ranges until the panel meter indicates better than 1/3 scale. When measuring intense sources, it is advisable to insert a neutral density filter before switching the instrument on.

5.3 When the proper range has been determined, cover the detector and zero the panel meter by adjusting the zero control knob. Uncover the sensor and take a reading.

5.4 Focus and Alignment: To measure variations of intensity over a given area, select and position an aperture suitable for the area to be measured (a five to one ratio of exposure area to sensor area is appropriate). Place the sensing module in the area in question and move it about noting the change in deflection. The source may then be moved up, down, laterally, or rotated until movement of the sensor produces no change in deflection or maximum deflection, etc.

5.5 Mercury Vapor Sources: In many mercury vapor light sources, the mercury vaporizes relatively slowly. As the mercury vaporizes the ratio of ultraviolet light to visible light increases, and the meter reading will increase. For accuracy, the meter reading should be taken after the vaporization process has been allowed to reach equilibrium.

6.0 SPECTRAL RESPONSE AND CALIBRATION

6.1 The PT100 Sensor assembly has a spectral response of from 200 to 660 millimicrons when unfiltered, By inserting optical glass or interference filters a great variety of spectral response curves can be derived.

6.2 The IL335 provides a readout in microamperes. This microampere reading can be converted to units of illuminance (foot-candles) or irradiance (microwatts per cm^2) by means of a calibration factor. Calibration factors are supplied with the PT100 Sensor assembly at a given wavelength upon request. The calibration factor provided (microwatts/cm^2 per microampere or foot candles per microampere) can be for an unfiltered photosensor, or for a filtered and attenuated (nuetral density filter) photosensor. The calibration factor assumes a monochromatic source at the wave length of calibration.

6.3 Example:

Calibration factor: $\frac{uw/cm^2}{\text{microamperes}} = 10$

Intensity reading with
monochromatic source
at 400 millimicrons: 10 microamperes

With the above values this source has an absolute radiant intensity of 100 uw/cm^2.

7.0 USE OF THE IL335 AS AN AUTOMATIC INTEGRATING EXPOSURE CONTROL

7.1 An exposure integrator is a great asset for light applications requiring a constant "dose" of light. For example: Any light sensitive reaction which varies with light intensity and duration, such as the exposure of photographic film and printing papers and the industrial exposure of "photo resist" used in chemical milling and etching applications. The extent

of the reaction is directly proportional to the product of light intensity (H) and the time (t). Therefore, this "light dose" may be controlled by either variable, while keeping the other constant. The time can be controlled by using an accurate stable electronic timer while the light may be held stable by regulating the power to the source. Unfortunately, light sources degrade during their life and sometimes fluctuate even over relatively short durations. For these reasons, it is desirable to control the "dose" directly with the IL335, which continually monitors the intensity and establishes the correct time for the desired exposure. In some applications the intensity varies because of transmission density variations as a part of a process or from sample to sample and in other cases because of aperture or optical changes. In these cases the IL335 is of the greatest value, since it will compensate for these drastic variations.

8.0 SET UP INSTRUCTIONS

8.1 Since the use of this instrument covers many applications, it is not in the scope of the instruction booklet to establish the best way to use the system for a specific case. The following will be a general explanation to establish guide lines to be applied to the particular application.

8.2 The integrator portion of the instrument has two knobs for selecting the required dose, a start and stop button, a light sensor, and two power outlets.

8.3 The light sensor is placed in a position to sample either

a protion of the light going to the process by using a beam splitter, fiber optics, positioning in close proximity or by sensing light at another location which will vary proportional to the light at the process. For example: Sensing the light from the source will compensate for line voltage and lamp ageing which will be proportional to the change at the end of the optical system. Some applications have even sensed the reflected light from the surface of photographic paper, etc., to control the exposure. The IL335 may be used over a wide dynamic light range; however, in some cases when sensing direct light from a bright source, it may be necessary to attenuate the intensity to the detector with a neutral density filter. This will become obvious when the exposure time is much to short for the application, even though the controls are selected to the highest "dose". If the exposure time is much too long for the lowest "dose" setting, then there is not enough light available. It then would be necessary to locate the detector in another location to increase the available light. Since the instrument has a dynamic range of 3000 to 1, it will normally be possible to get a light level which falls within the range of operation. By changing the dose selection, the exposure time will change until you have obtained a time equal to that which was previously acceptable. Further adjustment may be made to improve the process, but each selected dose will remain constant even though the light level changes. The dose units go from 10 to 80 by adding the numbers on both knobs. This is a logrithmic scale which permits you to make a change by an equal per centage no matter how long or how bright your exposure is. The actual

time for a particular setting will depend upon the intensity of light falling on the detector in each application, which is a function of the current from the light sensor. The enclosed chart shows the relationship between the sensor current, the time and "dose". For proper operation the intersection should fall inside the heavy border line on the chart. If it does not, then either more or less light must be made available to the light detector in order to produce an acceptable current and, therefore, an intersecion which is a typical exposure as described above. Then the range of light change is found by following the dose line which has been chosen to the maximum limits of the chart. In other words, suppose you set up the system and find that the dose which gives you the correct exposure is 60 and the exposure time under typical operation is ten seconds. The intersection between 60D and 10 sec. is 0.015 microamperes (sensor current) which is directly proportional to the typical light intensity. By following the 60D line to the extremes, we find the sensor current can go from .003 to 15 microamps. Now comparing this to the typical (0.015), the light can get 1000 times brighter (15 ÷ 0.015) or it can go down to 1/5 of the typical brightness. In fact, it can even get darker than that, and the unit will continue to operate with slightly reduced accuracy due to the dark current of the vacuum photodiode. As long as the operation is within the limits of the chart, the accuracy of integration is $\pm$ 1.5%.

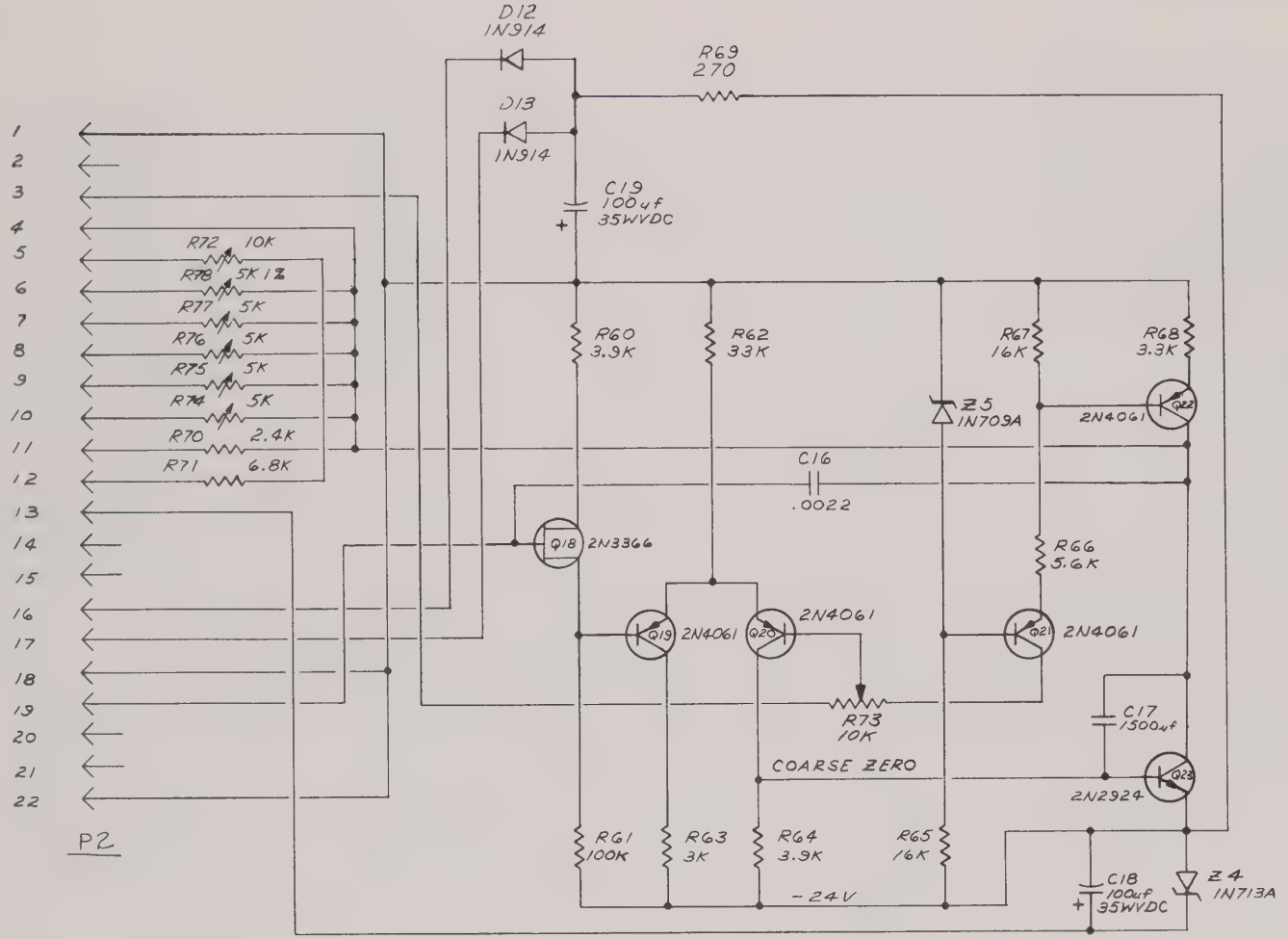
8.4 Operation out of these limits will reduce the accuracy of operation, but for many applications it would be more than acceptable.

8.5 The instrument has two outlet receptacles which will turn on or off an external load which is operated by standard "household" power (110-120 VAC, 60 H_z). This load may be a solenoid operated shutter or a low power light source. If the load is a very high power lamp or similar heavy load which will consume more than 5 Amps, then a power relay must be operated which in turn will power the heavy load.

8.6 The other controls are the "start" and "stop" push buttons on the front panel and a start cable which connects to the rear panel. The start button is used to start the exposure. If a foot switch is desired, the remote start cable is used. By momentarily connecting the two wires, start is initiated. This can be accomplished by a switch or relay, if some type of automatic operation is desired, The "STOP" button is not normally used but is available if one wishes to terminate the exposure prematurely.

8. The four "locked" potentiometers on the rear panel are for factory adjustments and should not require adjustment. If the units are purchased for use in multiple situations, it is possible to adjust the "Ca. Adj." so that all units will give the same exposure for the same dial setting.

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
	A	UPDATED DESIGNATIONS	2/19	



ITEM NO.	QTY REQ'D	DWG. SIZE	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
				LIST OF MATERIALS OR PARTS LIST

UNLESS OTHERWISE SPECIFIED
CAPACITOR VALUES ARE IN μF
RESISTOR VALUES ARE IN OHMS
DIMENSIONS ARE IN INCHES
TOLERANCE ON
DECIMALS .XX ± .X ± .XXX ± FRAC. ± ANGLES ±
CONCENTRICITY .005 TIR
ALL SHARP EDGES .018 MIN.
ALL MACH SURFACES 125 ✓

CONTRACT NO		
MFG. APPD		DATE
ENGR APPD	Chason	DATE 9.9.69
DRAWN	RED	DATE 8 Sept 69

MATERIAL:

FINISH:

NEXT ASSY.	USED ON
APPLICATION	

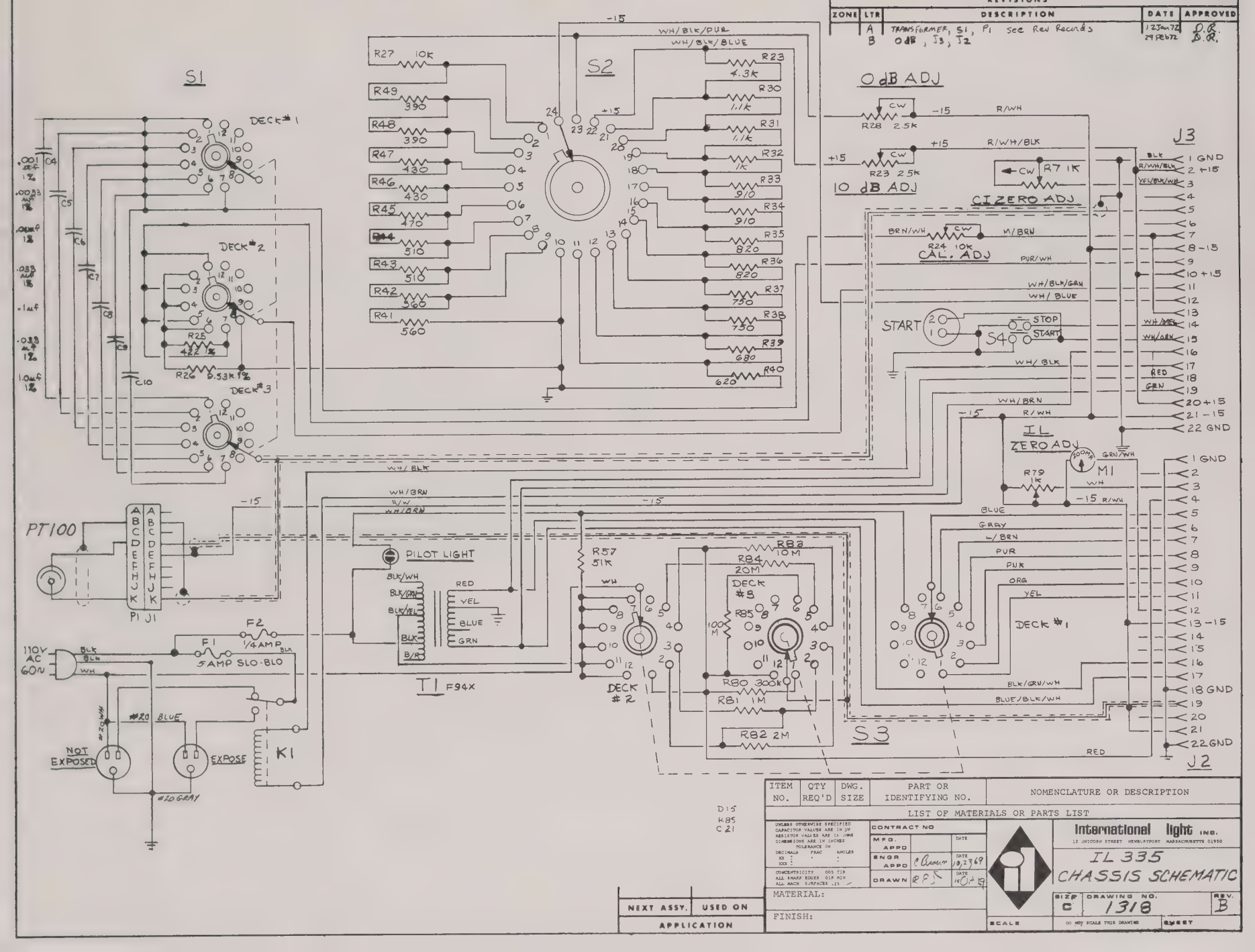
SCALE

International light IND.
12 UNICORN STREET, NEWBURYPORT, MASSACHUSETTS 01950

IL 335 AMP BOARD
SCHEMATIC

SIZE	DRAWING NO.	REV.
C	1307	A

DO NOT SCALE THIS DRAWING — SHEET



ITEM NO.	QTY REQ'D	DWG. SIZE	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION

LIST OF MATERIALS OR PARTS LIST

UNLESS OTHERWISE SPECIFIED CAPACITOR VALUES ARE IN UF, RESISTOR VALUES ARE IN OHMS, DIMENSIONS ARE IN INCHES. TOLERANCE ON DECIMALS XX ±, XXX ±, FRAC ±, ANGLES ±. CONCENTRICITY .005 TIR. ALL SHARP EDGES .010 MIN. ALL MACH. SURFACES 125

CONTRACT NO

		DATE
MFG. APPD		
ENGR APPD	C. Brown	12/23/69
DRAWN	R.F.S.	12/23/69

MATERIAL:

FINISH:

NEXT ASSY.	USED ON
APPLICATION	

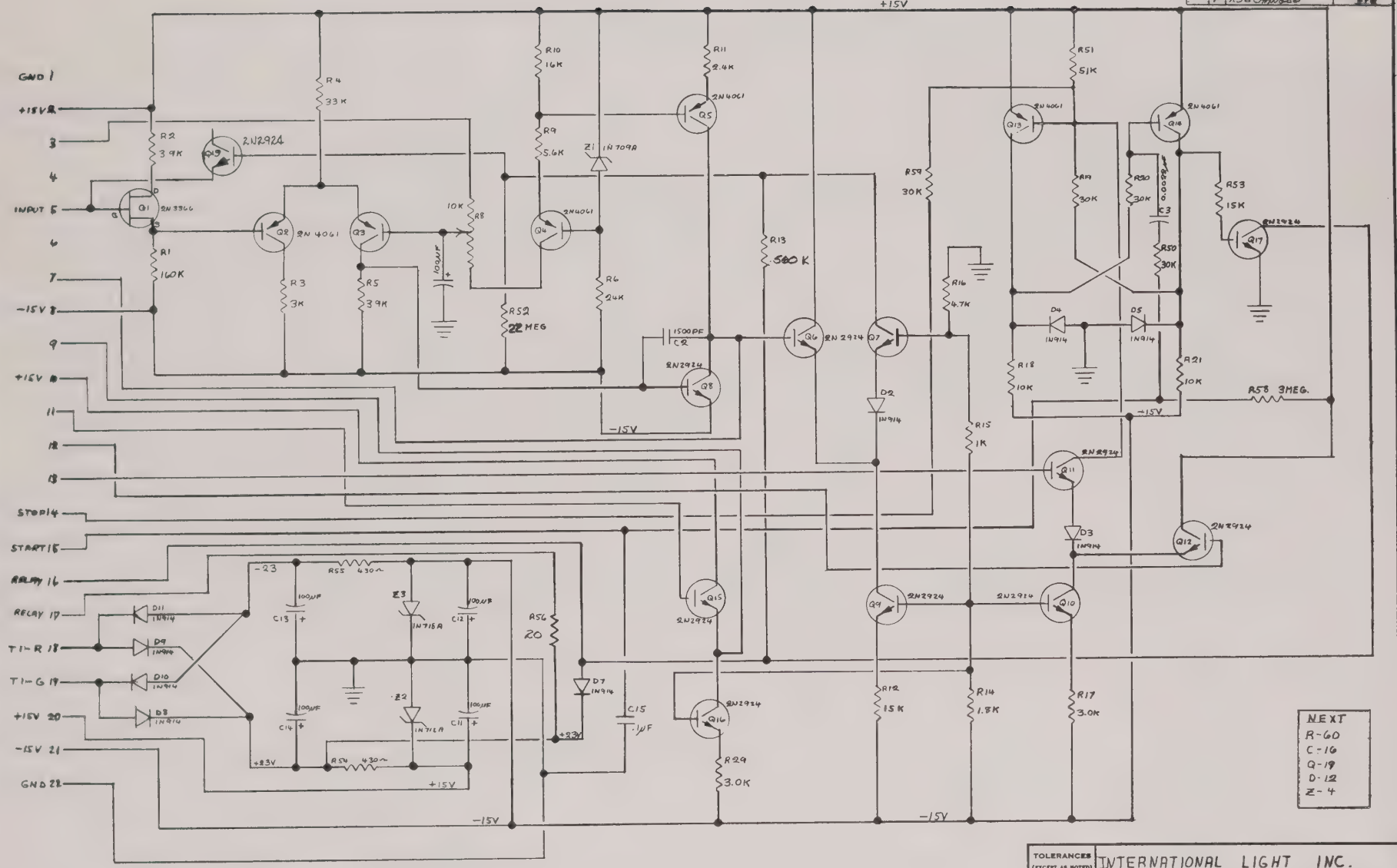
International light INC.
12 JUNIPER STREET NEWBURYPORT MASSACHUSETTS 01950

IL 335 CHASSIS SCHEMATIC

SIZE C | DRAWING NO. 1318 | REV. B

SCALE | DO NOT SCALE THIS DRAWING | SHEET

A	START & STOP and Ch.
B	Name Changed
B	R56 Changed 2002
C	C15 Added to card
D	R52 Changed
E	D1 Replaced with Q19
F	R56 CHANGED



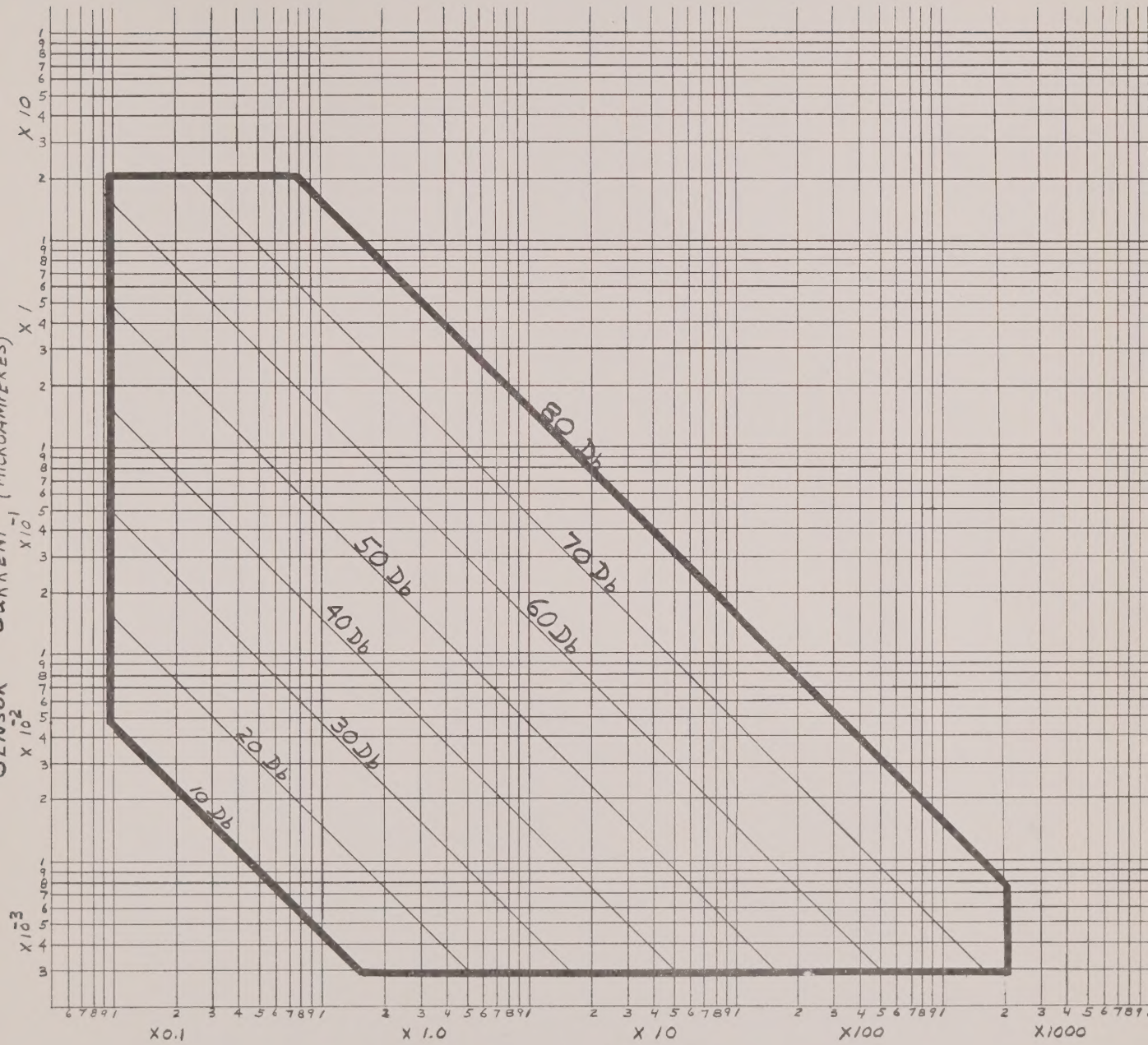
NEXT
R-60
C-16
Q-19
D-12
Z-4

NOTE: Q_1 V_{GS} = −0.3 to −2.5 @ 100 μa

R13 IN IL335 & CI335 IS 640K

RS3 & RS4 ARE THE SAME IN THE CI335 BUT 680 ohm IN THE IL335

TOLERANCES (EXCEPT AS NOTED)	INTERNATIONAL LIGHT INC.		
DECIMAL ±		SCALE	DRAWN BY P&P
FRACTIONAL ±	TITLE CI 335M BOARD SCHEMATIC		APPROVED BY D. Ryan
ANGULAR ±	DATE	DRAWING NUMBER C 1183G	


SENSOR CURRENT (MICROAMPERES)
X 10
X 1
X 10⁻¹
X 10⁻²
X 10⁻³
90 Db
70 Db
60 Db
50 Db
40 Db
30 Db
20 Db
10 Db
X0.1
X 1.0
X 10
X100
X1000
TIME (SECONDS)

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